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Postharvest Handling Technical Bulletin

CALALOO

Postharvest Care and Market Preparation



Technical Bulletin No. 26

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POSTHARVEST HANDLING TECHNICAL SERIES

CALALOO

Postharvest Care and Market Preparation

Ministry of Fisheries, Crops and Livestock
New Guyana Marketing Corporation
National Agricultural Research Institute

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Preface

This publication is part of a series of technical bulletins that seek to provide specific recommendations for improvements in postharvest care and market preparation for selected non-traditional agricultural products. The intended audience for this series is primarily extension agents.

Initial market assessments in current export markets and visits with producers and exporters in Guyana have shown the quality of fresh produce currently exported is uneven and in some instances very poor. Stages all along the export chain from harvest and pre-harvest to transportation and final export are all in need of improvement. Pre-harvest practices, sanitation at the packinghouse, packaging, bacterial and fungal problems, and transportation were all identified as areas where improvement could benefit the quality and increase the shelf life of Guyana's fresh produce exports. The technical bulletins address these issues specific to each product. Harvesting techniques and crop maturity indices are provided. Preparation for market, including cleaning, sorting, packing and transportation are covered. The bulletins address and recommend specific storage conditions, covering temperature and humidity controls. Finally the bulletins address postharvest diseases and insect damage.

The undertaking of these technical bulletins is a joint effort of the Ministry of Fisheries, Crops and Livestock; the New Guyana Marketing Corporation (NGMC) and the National Agricultural Research Institute (NARI) to improve quality, increase production and promote exports. As a team, the three agencies are working on the problems, limitations, and constraints identified in the initial reconnaissance surveys, from production and post harvest handling problems, to packaging and transportation, to final market.

Introduction

Calaloo is a popular leafy or salad vegetable available year round in the domestic market. Small volumes are also exported from Guyana to Canada, the U.S., and Barbados. There are two principal kinds of calaloo, produced from distinctly different plant species. One kind comes from the *Amaranthus* family (*Amaranthus spinosus*) and consists of young tender leaves and stems. The other kind consists of the young tender leaf and petiole of the eddoe plant.

A diversity of *Amaranthus* calaloo types are grown, differing in size, shape, and colour of the edible leaves. The plants usually grow around 1 meter (3.3 ft) in length. Most growers save their own seed or purchase seed of a selected race from another producer. This results in considerable variability in leaf characteristics. In addition, several imported cultivars are also available through agriculture supply stores.

Diversity also exists in the eddoe calaloo, although to a lesser degree than with the *Amaranthus* calaloo. The young eddoe (*Colocascia esculenta*) leaves are harvested when still tender and often used in soups or as wrappers for steamed foods.

Harvest Maturity Indices

Calaloo can be grown quickly and harvested regularly. Several different indices can be used to determine harvest maturity of calaloo, including the number of days following planting and the texture of the leaves/stems.

The number of days from seeding or transplanting provides a rough estimate of when to begin harvest. Harvest typically should begin about 45 to 50 days after planting.

Leaf and stem texture is another commonly used indicator of when to harvest. Callaloo leaves should be harvested right after they have fully expanded (Figure 1). The leaves and adjoining stems should be tender, succulent, and free of fiber.



Figure 1. Young leaves of eddoe (left) and *Amaranthus* (right) calaloo ready for harvest.

The tender young leaves and stems of calaloo can be harvested multiple times. Most growers obtain about six harvests per plant from *Amaranthus calaloo* before it begins to flower and form seeds. Harvesting typically finishes when the plant begins to form seeds, as the flavour diminishes and the texture becomes tougher. Harvest of newly formed eddoe calaloo leaves may also occur multiple times from the same plant. Harvest typically finishes when the size of the young leaves significantly diminishes due to a loss in plant vigour.

Harvest Methods

The tender young shoots of calaloo may be cut from the plant with a knife or snapped off by hand. The delicate leaves and stems should be handled gently to avoid tearing. The freshly harvested calaloo should not be placed on the ground. Rather, it should be put directly in the field container. Field containers can be baskets, plastic buckets, or well-ventilated plastic crates. In order to maintain product quality, calaloo should be put in the shade and kept as cool as possible. Avoid leaving the harvested calaloo in the sun or in a breezy location. It is recommended that harvesting be conducted during the coolest time of the day, typically in the early morning.

Calaloo should be harvested every 3 days. Regular picking increases yield. Flower buds should be removed as soon as they appear, since they reduce the plant's production ability.

Preparation for Market

Calaloo should be taken to the packing area as soon as possible after harvest, ideally within an hour after picking. It is an extremely perishable product and should be quickly cleaned, sorted, bunched, packed, and cooled.

Cleaning

Calaloo is usually washed and bunched before sale in the marketplace. If a small amount of calaloo is being harvested for sale at a nearby market, a small tub of cold water can be used to cool the calaloo. The tub can also be used by the picker as a field container (Figure 2). Clean water should be used with each new tub of harvested calaloo. Chilling calaloo by using cold water immediately after harvest will help maintain quality and prevent leaf and stem wilting.

In order to avoid the spread of disease, particularly bacterial soft rot, the wash water should be clean and sanitized with 150 ppm sodium hypochlorite and maintained at a pH of 6.5. The chlorine level



Figure 2. A small tub used for washing/cooling may also be used as the harvest container.

and pH of the wash water should be checked with paper test strips or a portable meter.

Grading/Sorting

Calaloo arriving from the field is usually quite variable in size, shape, and colour. Grading and sorting for uniformity of appearance is important to satisfy market expectations. Leaves which are torn, diseased, wilted, or spotted should be discarded. Only high quality, tender, uniformly green calaloo should be packed for market (Figure 3). Some market destinations prefer the calaloo to be wrapped in small bunches, while others prefer non-wrapped bulk leaves and stems. A common sized bunch for export is 500 gm (1 lb).



Figure 3. High quality fresh calaloo in the Parika market.

Packing

Calaloo should be packed in well-ventilated containers for efficient removal of heat due to product respiration. Calaloo packed in non-ventilated containers will be difficult to keep cool. Fiberboard cartons containing 5 kg (11 lb) of calaloo are commonly used for export. A total of 10 bunches, each weighing 500 gm (1 lb), are put in the carton. Wrapping pre-cooled bunches in perforated plastic bags will reduce wilting.

Temperature Control

Wilting and loss of freshness is a common postharvest problem with calaloo, since most Guyanese growers do not cool the vegetable or maintain a high storage relative humidity. At ambient temperature without cooling or humidity control, the market life for calaloo is only 1 day. Postharvest life can be extended for up to a week by the use of refrigeration and adding supplemental moisture to the storage atmosphere. For maximum market life, calaloo should be cooled immediately after harvest and stored at 0°C (32°F). The maximum acceptable holding temperature is 4°C (40°F). However, market life will be several days less at 4°C (40°F) compared to a week at 0°C (32°F). At temperatures above 15.6°C (60°F), the leaves and stems will rapidly wilt, turn yellow, and decay.

Relative Humidity

The high surface area and numerous pores in the leaf tissue make calaloo very susceptible to moisture loss and wilting. This results in the loss of leaf and stem quality. The storage environment should be very humid to minimize the loss of leaf freshness and avoid shriveling and adverse textural changes. For maximum market life, both kinds of calaloo should be held at 95% to 98% relative humidity (RH).

Principal Postharvest Diseases

The most common postharvest diseases of calaloo are bacterial soft rot and watery soft rot. Decay can be controlled by preventing wounds during harvest and handling, trimming off infected leaf tissue, washing in appropriately sanitized water, and storing the harvested calaloo as close to 0°C (32°F) as possible. In addition, the use of clean seed and pre-harvest application of approved fungicides will reduce the amount of disease inoculum in the field and lower the incidence of postharvest disease. Sanitary production practices will also reduce the build-up of the fungus in the soil. Weeds should be controlled because they harbour postharvest pathogens and their foliage creates a moist environment favouring disease development.

Bacterial Soft Rot

Bacterial soft rot is caused by various bacterial species including *Erwinia* and *Pseudomonas*. These bacteria are typically secondary disease pathogens that enter the leaf or stem tissue at the time of wounding. Infected tissue quickly decays and turns into a soft, slimy, foul-smelling mess at ambient temperatures.

Watery Soft Rot

Watery soft rot, caused by the fungus *Sclerotinia*, may be a problem on calaloo produced during the rainy season or in poorly drained fields. Symptoms appear as water-soaked spots on the outer leaves which eventually coalesce into a leaky soft tissue mass. Affected tissue often turns grey, giving rise to a fluffy white mould which eventually is dotted with black fungal bodies. In contrast to bacterial soft rot, there is no disagreeable odour associated with watery soft rot.

ANNEX I

PUBLICATIONS IN THE POSTHARVEST HANDLING TECHNICAL BULLETIN SERIES

PH Bulletin No. 1	Pineapple: Postharvest Care and Market Preparation, November 2002.
PH Bulletin No. 2	Plantain: Postharvest Care and Market Preparation, June 2003.
PH Bulletin No. 3	Mango: Postharvest Care and Market Preparation, June 2003.
PH Bulletin No. 4	Bunch Covers for Improving Plantain and Banana Peel Quality, June 2003.
PH Bulletin No. 5	Papaya: Postharvest Care and Market Preparation, June 2003.
PH Bulletin No. 6	Watermelon: Postharvest Care and Market Preparation, October 2003.
PH Bulletin No. 7	Peppers: Postharvest Care and Market Preparation, October 2003.
PH Bulletin No. 8	Oranges: Postharvest Care and Market Preparation, October 2003.
PH Bulletin No. 9	Tomato: Postharvest Care and Market Preparation, October 2003.
PH Bulletin No. 10	Okra: Postharvest Care and Market Preparation, October 2003.
PH Bulletin No. 11	Pumpkin: Postharvest Care and Market Preparation, January 2004.
PH Bulletin No. 12	Lime: Postharvest Care and Market Preparation, January 2004.
PH Bulletin No. 13	Grapefruit: Postharvest Care and Market Preparation, January 2004.
PH Bulletin No. 14	Passion Fruit: Postharvest Care and Market Preparation, January 2004.
PH Bulletin No. 15	Green Onions: Postharvest Care and Market Preparation, January 2004.
PH Bulletin No. 16	Sweet Potato: Postharvest Care and Market Preparation, January 2004.
PH Bulletin No. 17	Eggplant (Boulanger): Postharvest Care and Market Preparation, January 2004.
PH Bulletin No. 18	Avocado (Pear): Postharvest Care and Market Preparation, January 2004.
PH Bulletin No. 19	Bitter Melon: Postharvest Care and Market Preparation, January 2004.
PH Bulletin No. 20	Bora: Postharvest Care and Market Preparation, April 2004.
PH Bulletin No. 21	Cassava: Postharvest Care and Market Preparation, April 2004.

PH Bulletin No. 22	Eddoes: Postharvest Care and Market Preparation, April 2004.
PH Bulletin No. 23	Ginger: Postharvest Care and Market Preparation, May 2004.
PH Bulletin No. 24	Breadfruit: Postharvest Care and Market Preparation, May 2004.
PH Bulletin No. 25	Cabbage: Postharvest Care and Market Preparation, May 2004.
PH Bulletin No. 26	Calaloo: Postharvest Care and Market Preparation, May 2004.

OTHER PLANNED PUBLICATIONS

Coconut: Postharvest Care and Market Preparation.

Cucumber: Postharvest Care and Market Preparation.

Lemon: Postharvest Care and Market Preparation.

Starfruit: Postharvest Care and Market Preparation.

Tangerine: Postharvest Care and Market Preparation.

Yam: Postharvest Care and Market Preparation.

Introduction

There are two main kinds of calaloo, produced from distinctly different plant species. One kind comes from the Amaranthus family and consists of young tender leaves and stems. The other kind consists of the young tender leaf and stem of the eddoe plant.

A variety of Amaranthus calaloo types are grown, differing in size, shape, and colour of the edible leaves. The plants usually grow around 1 meter (3.3 ft) in length. Variety also exists in the eddoe calaloo, although to a lesser degree than with the Amaranthus calaloo.

Harvest Maturity Indices

Calaloo can be grown quickly and harvested regularly. Several different methods can be used to determine harvest maturity of calaloo, including the number of days following planting and the texture of the leaves/stems.

The number of days from seeding or transplanting provides a rough estimate of when to begin harvest. Harvest normally should begin about 45 to 50 days after planting.

Leaf and stem texture is another commonly used sign of when to harvest. Calaloo leaves should be harvested right after they have fully expanded. The leaves and adjoining stems should be tender, juicy, and free of fiber.



The tender young leaves and stems of calaloo can be harvested multiple times. Most growers get about six harvests per plant from Amaranthus calaloo before it begins to flower and form seeds. Harvesting usually finishes when the plant begins to form

seeds, as the flavour lessens and the texture becomes tougher. New eddoe calaloo can be harvested several times from the same plant.

Harvest typically finishes when the size of the young leaves significantly reduces due to a loss in plant vigour.

Harvest Methods

The tender young shoots of calaloo may be cut from the plant with a knife or snapped off by hand. The delicate leaves and stems should be handled gently to avoid tearing. The freshly harvested calaloo should not be placed on the ground. Rather, it should be put directly in the field container. Field containers can be baskets, plastic buckets, or well-ventilated plastic crates. In order to maintain product quality, callaloo should be put in the shade and kept as cool as possible. Avoid leaving the harvested calaloo in the sun or in a breezy location. It is suggested that harvesting be done during the coolest time of the day, usually in the early morning.

Calaloo should be harvested every 3 days. Regular picking increases yield. Flower buds should be removed as soon as they appear, since they reduce the plant’s ability to grow more.

Preparation for Market

Calaloo should be taken to the packing area as soon as possible after harvest, ideally within an hour after picking. It is a very fragile product and should be quickly cleaned, sorted, bunched, packed, and cooled.



Cleaning

Calaloo is usually washed and bunched before sale in the marketplace. If a small amount of calaloo is being harvested for sale at a nearby market, a small tub of cold water can be used to cool the calaloo. The tub can also be used by the picker as a field container. Clean water should be used with each new tub of harvested calaloo. Chilling calaloo by using cold water

immediately after harvest will help keep quality and prevent leaf and stem wilting.

In order to avoid the spread of disease, particularly bacterial soft rot, the wash water should be clean and sanitized with 150 ppm hypochlorous acid (household bleach) and maintained at a pH of 6.5. This is equal to 2 oz of household bleach (such as Marvex) per 5 gallons of water, or .3 liters of bleach per 100 liters of water. The chlorine level and pH of the wash water should be checked with paper test strips or a portable meter.

Grading/Sorting

Calaloo coming from the field is usually quite uneven in size, shape, and colour. Grading and sorting for sameness of appearance is important to satisfy market requirements. Leaves which are torn, diseased, wilted, or spotted should be thrown out. Only high quality, tender, green calaloo should be packed for market. Some markets prefer the calaloo to be wrapped in small bunches, while others prefer non-wrapped bulk leaves and stems. A common sized bunch for export is 500 gm (1 lb).



Packing

Calaloo should be packed in well-ventilated containers to reduce heat due to product respiration. Calaloo packed in non-ventilated containers will be difficult to keep cool. Fiberboard cartons containing 5 kg (11 lb) of calaloo are commonly used for export. A total of 10 bunches, each weighing 500 gm (1 lb), are put in the carton. Wrapping pre-cooled bunches in perforated plastic bags will reduce wilting.

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Relative Humidity

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Bacterial Soft Rot

Bacterial soft rot is caused by various bacterial species that enter the leaf or stem tissue after wounding. Infected tissue quickly decays and turns into a soft, slimy, foul-smelling mess at average temperatures.

Watery Soft Rot

Watery soft rot may be a problem on calaloo produced during the rainy season or in poorly drained fields. Symptoms appear as water-soaked spots on the outer leaves that eventually combine into a leaky soft tissue mass. Affected tissue often turns grey, giving rise to a fluffy white mould which eventually is dotted with black fungal bodies. In contrast to bacterial soft rot, there is no unpleasant odor associated with watery soft rot.



New Guyana Marketing Corporation

CALALOO

Postharvest Care and Market Preparation Information Sheet



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With the assistance of
The United States Agency for International Development

This information sheet provides growers and agriculture extension personnel with a summary of the recommended harvest and postharvest handling practices for calaloo. A more technical and detailed bulletin is available from the New Guyana Marketing Corporation (NGMC) and National Agricultural Research Institute (NARI).